

FOUO



**This Briefing is
UNCLASSIFIED**

**Modeling,
Simulation, and Analysis
(MS&A)**
**Space User's Group
(SPUG)**

MAJ Bill McLagan
USSPACECOM
Analysis Directorate
Comm: (719) 554-5122
DSN: 692-5122

Fax: x4070

Email:

bill.mclagan@peterson.af.mil

Class:

11-12 June 2002

FOUO



The Problem

Limited findings to quantify the added value of space systems (and CNO)..for the warfighter

Limited space (and CNO) representation in modeling and simulation for analysis ... also affects training & acquisition

Limited funding to address the problem through analysis, wargaming, and infusing space in exercises

Need to start with requirements:

- ⇒ Model deficiencies (i.e. suite of space and CNO models)
- ⇒ Space functionality requirements (e.g. data, algorithms, **measures of effectiveness / performance**, etc.)
- ⇒ Funding requirements



MS&A Findings

Defense Science Board Task Force Report titled “Space Superiority” dated Sep 99:

- "...nation currently lacks the necessary modeling and simulation capabilities required to fully and appropriately assess the “military utility and worth” of national security space systems.
- "...deficiency undermines our ability to correctly balance the funding priorities between space systems, weapons systems and other support junctions to maximize US military force combat effectiveness.

Army Transformation Wargame held April 2001 at Ft. Knox, KY After Action Report (AAR):

- "There was difficulty assessing or measuring the effectiveness of the Objective Force as situational awareness decayed during the campaign. The models used during the wargame lacked the ability to adequately assess the results of lethal and non-lethal space, CNO, and IO activities. In the end, there were numerous insights overlooked (across all domains of military operations) due to the lack of sufficient and relevant models"

UNCLASSIFIED



Space and CNO Functionality

Force Enhancement (Warfighter Support)

Early Warning



Space Weather



Space-Based ISR

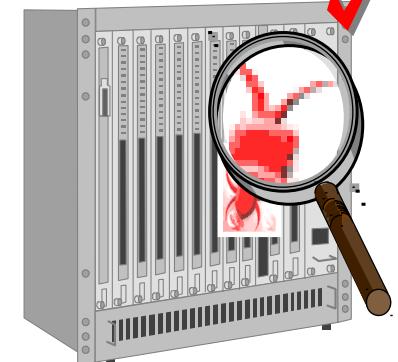


Space Derived Weather



Computer Network Operations (CNO)

Computer Network Attack (CNA)



Computer Network Defense (CND)

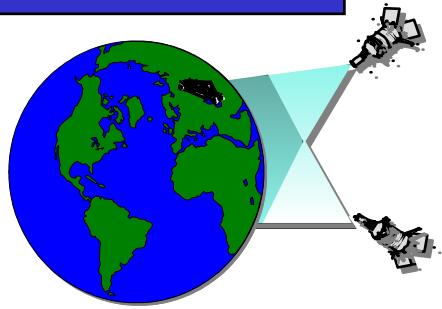


UNCLASSIFIED

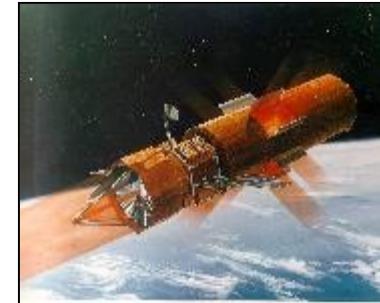


Space and CNO Functionality (Cont.)

Space Control



Force Application (Space Warfare)

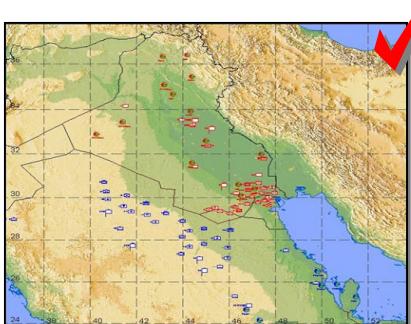


Four key Space Control tasks:

- Protection of Critical Space Systems
- Prevention of Unauthorized Access
- Negation of Hostile Systems
- Surveillance of Space

Space Support Space Systems Operations

Blue Force Tracking (BFT)



Space Lift



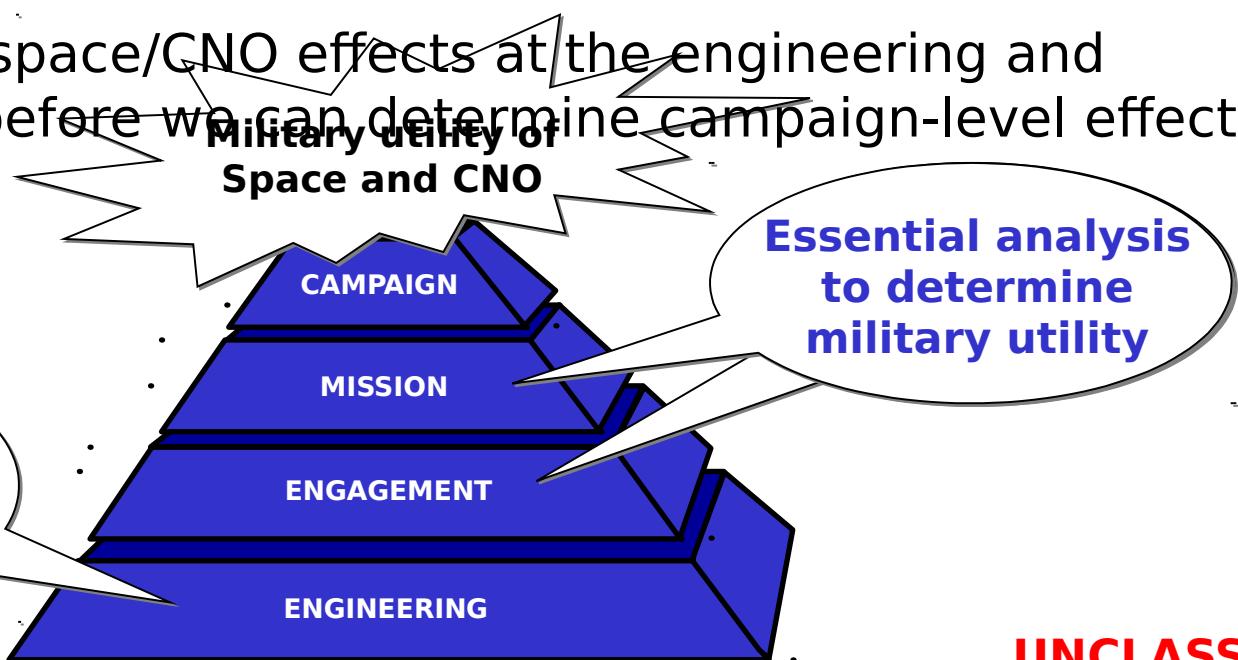
Satellite Ops





Bottom Line

- Limited space/CNO functionality included in MS&A...including JWARS
- Not all space/CNO mission areas are included at the the desired level of resolution...in any campaign model and few mission models
- Must quantify space/CNO effects at the engineering and mission-level before we can determine campaign-level effects





Who's Doing Space / CNO Analysis

<u>Organization</u>	<u>Area of Study</u>	<u>Method or N</u>
★ AFSAA	Various	Various
★ AFSPC ASAC	Various	Various
★ JS J8 / IDA	JROC Study	Various
★ SMDBL	Army FACT/Various Other	Various
★ STATCOM	CNA Analysis	Various
★ USACAA	AEIS-ISR	Pol-Mil Gaming
★ USMC (Quantico)	Various	Various
★ USSPACECOM/AN	GPS, ISR, & BFT	Various

Resources:

<http://ics81.js.smil.mil/> (includes POCs for some efforts above)
<http://www.msiac.dmso.mil/SPUG>
<https://stn.dtic.smil.mil/>
<http://www.ih.navy.mil/mast/M%20and%205%20Web%20Links%20Directory.htm>
<http://cafmsr.afams.af.smil.mil/> (MSRR - Classified)
<http://afmsrr.afams.af.mil/> (MSRR - Unclassified)





What's Overall Needed to Fix the Problem

Required Commitment

Identify space and CNO as a priority of funding for MS&A and MS&A as a priority for space and CNO



Gain commitment among the space and CNO MS&A stakeholders (SPUG, MORS, etc.)



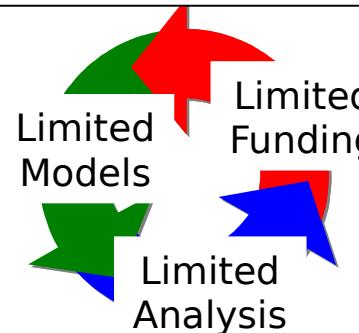
Identify/Develop a suite of models for space and CNO



Identify requirements for space and CNO MS&A (e.g. MOEs / MOPs, algorithms, data, etc.) - SPUG



Restated Problem



Infuse space and CNO into M&S for training exercises



Perform analysis of space-based systems and CNO

Imperatives

The opportunity is ripe to solve the problem with the right commitment

End State

Quantify the added value of space and CNO in joint military ops



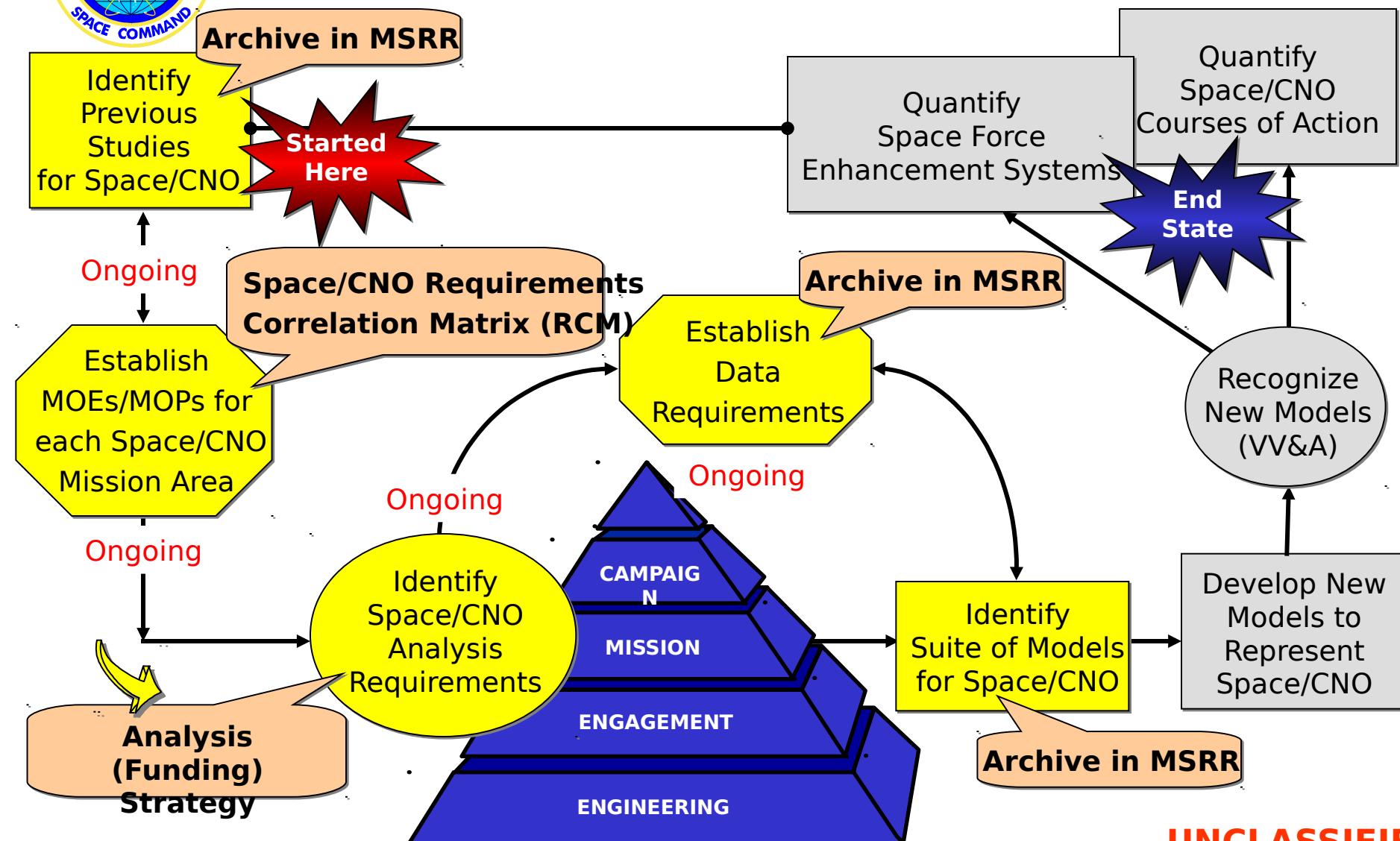
SPUG Charter

Forum of space and MS&A stakeholders gathered to:

- ⇒ Define requirements for:
 - ✓ Model deficiencies (i.e. suite of space and CNO models)
 - ✓ Data requirements
 - ✓ Algorithms
 - ✓ MOEs/MOPs
 - ✓ Funding requirements
- ⇒ ..to quantify the military utility of space and CNO in joint military ops through MS&A
- ⇒ ...by creating a win-win situation for the DoD, joint service, and private/academic sector communities by sharing efforts

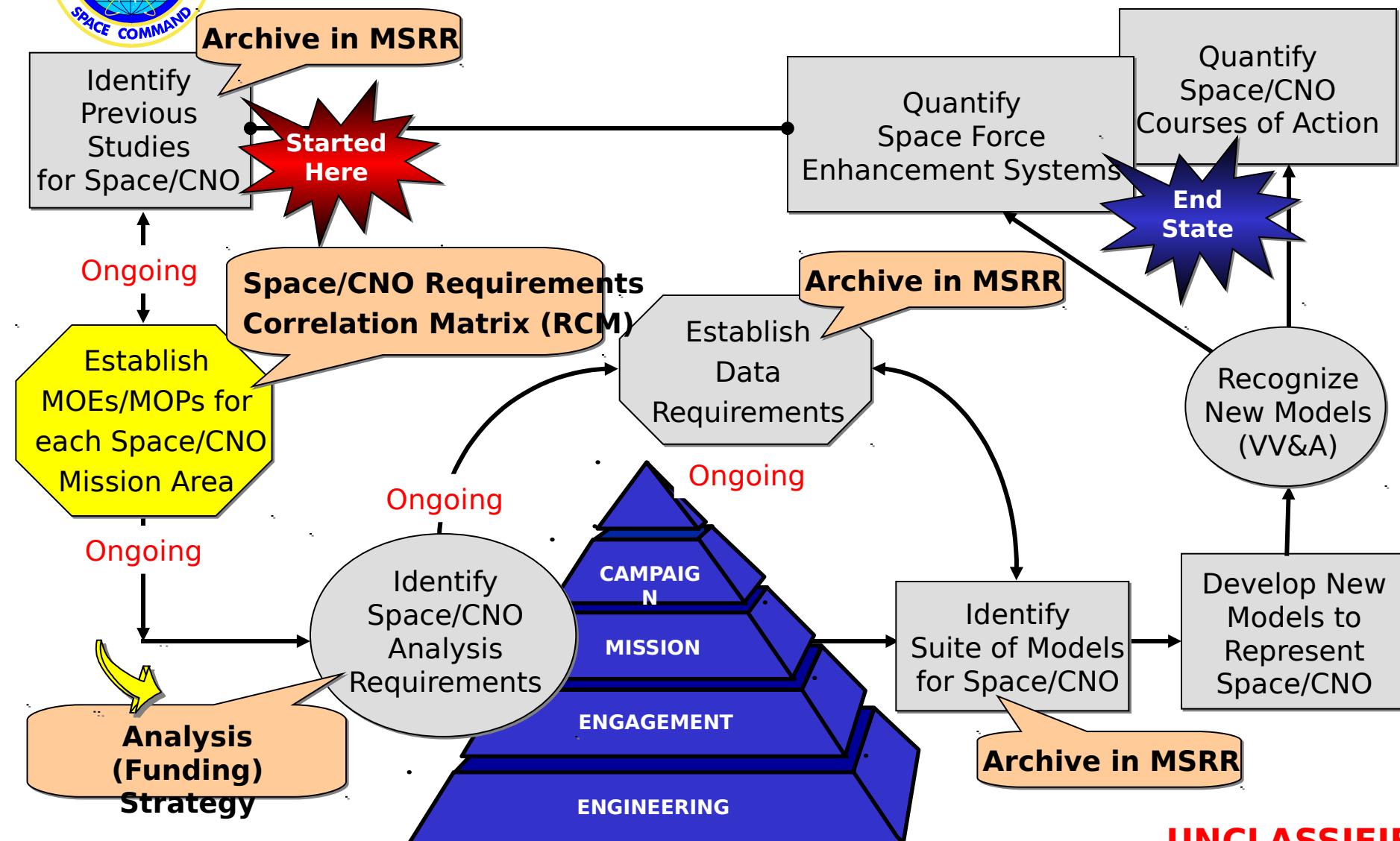


SPUG Strategy





SPUG Strategy





Requirements Correlation Matrix (RCM)

Mission Area	Op. Threshold	Op. Limitations	Threat	Mission-Level Effects	Collateral Effects	Campaign-Level Effects	References
Force Enhancement							
Early Warning							
Pos/Nav (GPS)							
SATCOM							
ISR							
Weather							
Computer Network Operations (CNO)							
Attack (CNA)							
Defense (CND)							
Etc.							



SPUG Objectives, 11-13 June 02

- Review (ongoing) activities since the last SPUG
 - JWARS development
 - JWARS Space Strategic Partner (JSSPAR)
 - DMSO activities
 - Army FACT effort
 - Ongoing analysis efforts
- Make progress toward identifying qualitative/quantitative space/CNO effects for the warfighter



SPUG Agenda, 11-13 June 02

Tuesday, 11 June 2002, Atrium II, Room 120

0800-0900	Welcome/	Intro Brief	MAJ McLagan (USSPACECOM)
0930-1030	JWARS Update	Lt Col McIntyre (JWARS JPO)	
1030-1130	JSSPAR Update	Ron Smith (GRCI Corp.)	
1130-1330	Lunch Self		
1330-1430	DMSO Brief	LtCol Hadinger (DMSO)	
1430-UTC	Army FACT Brief	Mr. Steve Elliott (SMDBL)	

Wednesday, 12 June 2002, Atrium II, Room 120

0800-0930	Vignette Brief	Mr. Jim Sheedy (TASC)
0930-1000	Intro to WG Session	MAJ McLagan (USSPACECOM)
1000-1130	MOE/MOP Brainstorming	Discussion Working Groups
1130-1330	Lunch Self	
1330-1530	MOE/MOP Brainstorming	Discussion Working Groups



Taskers from Dec.'01 SPUG

Tasker:

Post briefings/minutes from Dec SPUG (each SPUG)

POC:

USSPACECOM

Status as a community:

Posted at

www.msiac.dmso.mil/SPUG



ID requirements for space / CNO MS&A

All space MS&A organizations / services

Space MS&A stakeholders need to identify their individual requirements



Lead and leverage analysis to quantify space / CNO in joint military ops and homeland defense

All space MS&A organizations / services

Stakeholders need to highlight their analytical efforts to quantify the military utility of space and CNO



Populate and maintain an MSRR for space / CNO analysis activity

All space MS&A organizations / services

Stakeholders need to register and populate the MSRR at <http://cafmsrr.afams.af.smil.mil> and <http://msrr.mil>





Taskers from Dec.'01 SPUG (Cont.)

Tasker:

Capture the quantitative effects / measures of space / CNO analysis in the Requirements Correlation Matrix (RCM)

POC:

USSPACECOM
(with help from AFSPC, SPUG, etc.)

Status as a community:

Working at June 02 SPUG





JSSPAR Taskers from Dec.'01 SPUG

Tasker:

Establish functionality requirements for each space mission area in JWARS (also applies to other mission & campaign models)

POC:

USSPACECOM & JSSPAR / JWARS folks

Status as a community:

Ongoing; Being briefed at the June 02 SPUG



Establish data requirements for space representation in JWARS (also applies to other mission & campaign models)

USSPACECOM & JSSPAR / JWARS folks

Ongoing; Being briefed at the June 02 SPUG



Perform model runs with JWARS to evaluate space functionality

USSPACECOM & JSSPAR / JWARS folks

Being addressed as a separate effort with the JWARS JPO



FOUO



**This Briefing is
UNCLASSIFIED**

**Modeling,
Simulation, and Analysis
(MS&A)**
**Space User's Group
(SPUG)**

MAJ Bill McLagan
USSPACECOM
Analysis Directorate
Comm: (719) 554-5122
DSN: 692-5122

Fax: x4070

Email:

bill.mclagan@peterson.af.mil

11-13 June 2002

FOUO

UNCLASSIFIED



SPUG Agenda, 11-13 June 02

Tuesday, 11 June 2002, Atrium II, Room 120

0800-0900	Welcome/	Intro Brief/Review Taskers MAJ McLagan (USSPACECOM)
0930-1030	JWARS Update	Lt Col McIntyre (JWARS JPO)
1030-1130	JSSPAR Update	Ron Smith (GRCI Corp.)
1130-1330	Lunch Self	
1330-1430	DMSO Brief	LtCol Hadinger (DMSO)
1430-UTC	Army FACT Brief	Mr. Steve Elliott (SMDBL)

Wednesday, 12 June 2002, Atrium II, Room 120

0800-0930	Vignette Brief	Mr. Jim Sheedy (TASC)
0930-1000	Intro to WG Session	MAJ McLagan (USSPACECOM)
1000-1130	MOE/MOP Brainstorming Discussion	Working Groups
1130-1330	Lunch Self	
1330-1530	MOE/MOP Brainstorming Discussion	Working Groups

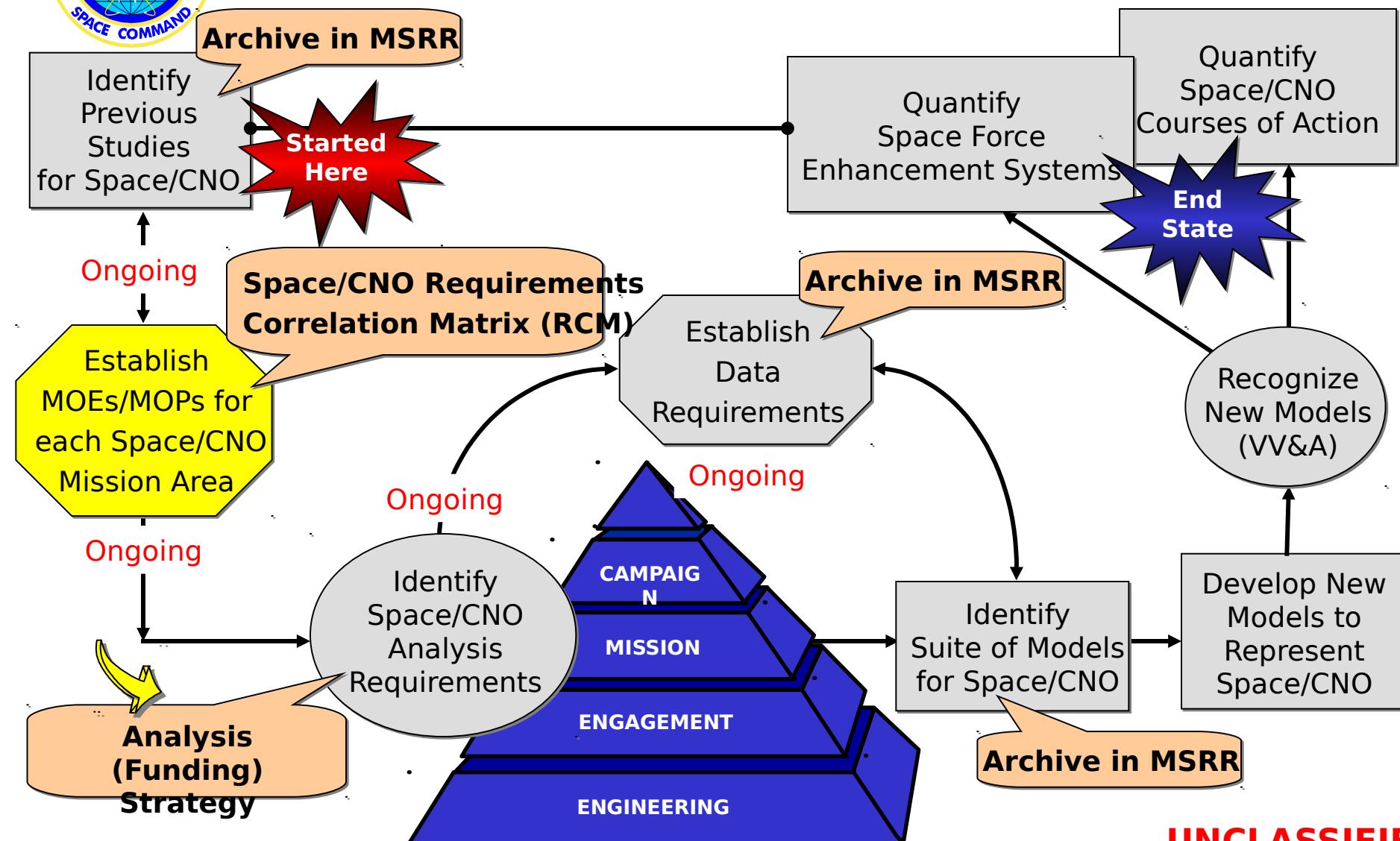
Thursday, 13 June 2002, Atrium II, Room 120

0800-0930	MOE/MOP Brainstorming Discussion	Working Groups
0930-1100	WG Outbriefs	Working Groups
1130-UTC	Wrap-up/Discussions	MAJ McLagan

UNCLASSIFIED



SPUG Strategy





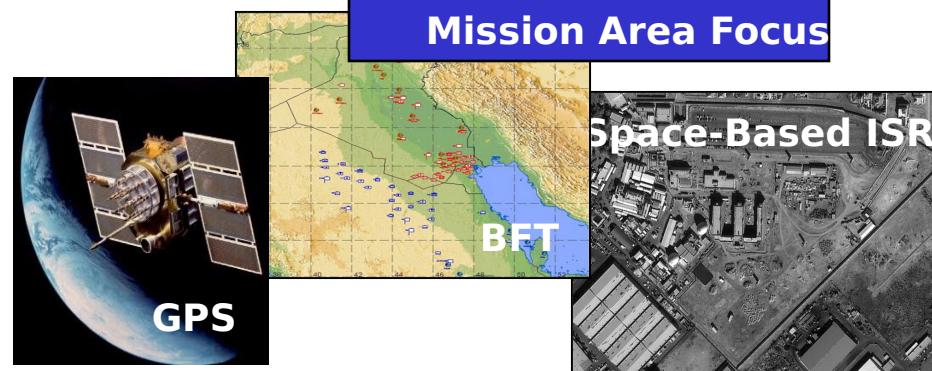
Requirements Correlation Matrix (RCM)

Mission Area	Op. Threshold	Op. Limitations	Threat	Mission-Level Effects	Collateral Effects	Campaign-Level Effects	References
Force Enhancement							
Early Warning							
Pos/Nav (GPS)							
SATCOM							
ISR							
Weather							
Computer Network Operations (CNO)							
Attack (CNA)							
Defense (CND)							
Etc.							

UNCLASSIFIED



Vignette Scenario



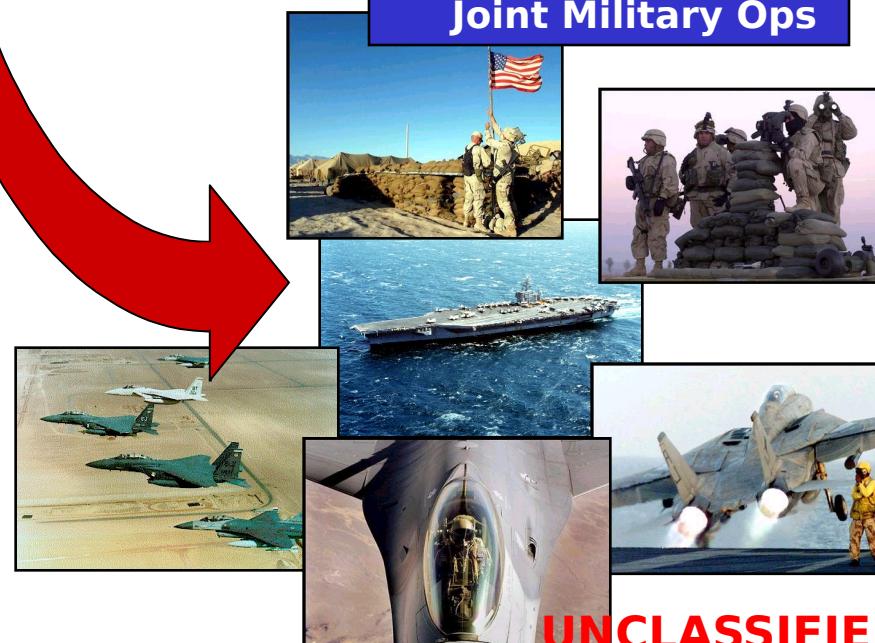
Computer Network Attack (CNA)



Homeland Defense



Joint Military Ops



UNCLASSIFIED



Rules of Engagement

- Identify a “team leader” (spokesperson) and a “recorder” (i.e. someone who knows Powerpoint)
- We have a reasonable time limit
- Think “outside the box” for space/CNO effects
- Do not evaluate ideas...no idea is ridiculous
- Make bullets self explanatory (e.g. identify acronyms, etc.)
- Can discuss at the SECRET COLLATERAL-level...mark slides appropriately
- Each group will look at each mission area...known as the Delphi method
- End State:
 - Leverage the diverse SPUG expertise to qualify/quantify effects of space/CNO in joint military ops and Homeland Security for the warfighter
 - Capture the knowledge of space/CNO effects (i.e. Space/CNO RCM, MSRR, individual stakeholder databases, etc.)



GPS Effects - Joint Military Ops

- Aircraft must fly at a lower altitude to see targets because use of PGMs is degraded
- Can use smaller caliber bomb with improved GPS accuracy
 - Added benefit is minimized collateral damage
 - Another benefit is improved logistics with smaller bombs
- Minimization of Fratricide using more accurate weapons
- Decreased formation time with accurate navigation
- Support for Common Operational Picture through secure communication (timing)
 - Support to BFT and ISR
- Reduced sorties (minimizes attrition)
- Reduced munitions
- Smaller presence required for Force Projection
- Improved standoff capability (TLAM as an example, also JSOW)
- Improved CSAR
- Public opinion--clean warfare with minimum blue force loss, and minimum collateral damage and minimum impact on civil infrastructure



Effects - Joint Military Ops (Cont.)

- Support mine countermeasures (MCM)
- Support mine emplacement
- Permits small unit operations in place of large scale operations
- Minimizes many aspects of logistic chain
- Facilitates insertion and extraction of SOF
- Improves secure comm throughput (effective/efficient use of bandwidth)!!!
 - Increased demand on bandwidth due to people asking, "where am I?" over the net
- Supports precision navigation
- More accurate determination of impact point for inbounds
- Synchronization of forces (Precision Maneuver)
- Precise Targeting
- Denial of Red Force use of GPS
 - Slows down military operations
 - Prevents use of precision GPS weapons against Blue Force
- Situational Awareness of Space Assets (knowledge of Blue Force sats)



Effects - Joint Military Ops (Cont.)

- Support quicker and more accurate employment/reemployment of artillery
 - More precise fires thru known location and precision munitions
 - Minimizes Reds counterfire/attack ops
- Support for Nuclear detection
- Support for nuclear attack capabilities
- More effective close air support operations and naval surface fire support
 - flexibility of aerial platforms (multi-role AC = B-52s)
- Time hacks (synchronized ops)
- Red COAs vs. blue GPS infrastructure
 - blue GPS accuracy is severely degraded



GPS Effects - Homeland Security

- Able to track emergency vehicles for crisis response
- Support Digital cellular service
- Provides banking secure comm synchronization
 - ATMs, Securities Trading, International Banking
- Support to critical infrastructure
 - Supports E-911 cellular location capability
 - EMS dispatch and management
 - Wildfire (natural disaster) management (FEMA uses = various uses)
 - Power grid (timing for power transmission across the country)
 - Civil aircraft (private) (route navigation)
 - Package distribution and delivery services (etc.)
 - Commercial shipping (waterway/coastal navigation - e.g. Mississippi)
 - Loss of Internet timing
- Examine denial of GPS to Threat and collateral effects to critical infrastructure



BFT Effects - Joint Military Ops

- Reduced fratricide by improved situational awareness of friendly forces
 - improved decision making due to improved SA (improved = more rapid, more accurate)
 - provides a status of forces
- What about dynamic friend vs foe situation?
 - Foe gets ahold of BFT system
 - Lack of allied use of BFT may cause further confusion
- Effective (on time) logistics
- Economy of force (more efficient use of forces)
- Dynamic re-tasking of forces
 - react to changing situation based on improved SA of blue forces
 - fusion of information systems (ISR, BFT, etc)
- May reduce need for ISR analysis of known blue force locations
- Improved targeting by FOs due to real time unit location knowledge
 - provides another control measure in addition to FSCL, etc
- Better AAR capability as a training aid (improved TTPs, doctrine, etc)
- Improved CSAR capability



BFT Effects - Homeland Security

- Status of forces for emergency response = improved response time
 - wildfires
 - commercial transport (shipping, trucking, etc)
 - reroute for efficient operations
- Monitoring of hazardous cargo
- Better management of (nuclear) security forces
 - contain threats by coordinating blue force response
- How do you integrate BFT into the crisis/consequence management network?
- How do you separate tracking of blue guys turned red?



Rules of Engagement

- Identify a “team leader” (spokesperson) and a “recorder” (i.e. someone who knows Powerpoint)
- We have a reasonable time limit
- Think “outside the box” for space/CNO effects
- Do not evaluate ideas...no idea is ridiculous
- Make bullets self explanatory (e.g. identify acronyms, etc.)
- Can discuss at the SECRET COLLATERAL-level...mark slides appropriately
- Each group will look at each mission area...known as the Delphi method
- End State:
 - Leverage the diverse SPUG expertise to qualify/quantify effects of space/CNO in joint military ops and Homeland Security for the warfighter
 - Capture the knowledge of space/CNO effects (i.e. Space/CNO RCM, MSRR, individual stakeholder databases, etc.)



ISR Effects - Joint Military Ops

- Rapid, low risk battle damage assessment (BDA)
- Intentional spoofing based on known collection times (red and blue capability)
 - Heat signatures from AC, spectral signatures
- Planning strike times (ATO) according to over flight times (have a space tasking order (STO))
 - Coordinate IMINT, SIGINT, MASINT, etc
 - Becomes predictable
- Tracking proliferation based on MASINT
- Determine activity level (increase vs. decrease) based on MASINT signatures (also acoustics)
- Battlespace characterization (situational awareness)
 - Renewed battlespace characterization
- Military ops start due to ISR indications (treaty violation, etc)
 - “Tip off”
 - Across multi-discipline areas
- Mission rehearsal based on situational awareness (“god’s eye” view)



Effects - Joint Military Ops (Cont.)

- Classify port capabilities (activity, flow, choke points, etc.)
- Not always space-based ISR systems required to do (HUMINT, airborne sensors, commercial crafts, UAVs, etc.)
 - Collection management between all sensor types (data fusing)
- Work from a adversarial/archaic (caveman tactics) framework
 - Asymmetrical warfare (inflict large amounts of damage at a low cost)
- Interview the postal worker and establish the psychological profile
- Affects target location error for precision engagement
- Use of non-ISR assets for intelligence (Weather Sats)
 - Night time visual imagery
 - Disruptions of weather systems as tipper
 - Natural disasters as model
- Ham radio exploitation
 - Command and control of amateur satellites
- Support OB and electronic OB
- Improved response time to a threat scenario



ISR Effects - Homeland Security

- Calibrate on known spectral signatures (marijuana patches in CA to calibrate for South America applications counter drug ops)
- Change detection of potential attack staging areas against the US (illegal immigrations, etc)
- Locating WMD (weapons, effects, etc) before or after incidents
- Characterization of natural disasters
 - Foliage characterization, crop growth/famine
- Historical database for predicting future events based on past incidents
 - Fusing the data among national agencies, commercial databases (insurance, stock market, etc for "tip off" info)
 - Vulnerability of databases to outside attack (CNA)
- Cell phone intercepts (SIGINT)
- Precision navigation in commercial vehicles
 - Correlate private sector info with national databases
 - Real time situational awareness (geo-rectified data) for self and others
 - Tracking long haul trucking/shipping (potential WMD or tracking sensitive loads)



Effects - Homeland Security (Cont.)

- Mission rehearsal to particular scenarios based on known info
- Classify port capabilities and activities (traffic flow, loading, unloading)
 - Applies to red and blue side
- Deceive intel targets influence collection capability
 - As soon as you start observing an action, you start influencing the action
 - drive adversary to a particular COA based on deception/influence
- Use of non-ISR assets for intelligence (Weather Sats)
 - Night time visual imagery
 - Disruptions of weather systems as tipper
 - Natural disasters as model
- Ham radio exploitation
 - Command and control of amateur satellites (threat vs asset to DoD?)

Work from a adversarial/archaic (caveman tactics) framework Interview the postal worker and establish the psychological profile

Improved response time to a threat scenario

FOUO



**This Briefing is
UNCLASSIFIED**

**Modeling,
Simulation, and Analysis
(MS&A)**
**Space User's Group
(SPUG)**

MAJ Bill McLagan
USSPACECOM
Analysis Directorate
Comm: (719) 554-5122
DSN: 692-5122

Fax: x4070

Email:

bill.mclagan@peterson.af.mil

11-12 June 2002

FOUO